Meter orientation and location p. 30
Standalone versus integrated package p. 31
References p. 31
Multiphase Flow Metering Principles p. 33
MFM Fundamentals p. 33
Categories of Instruments p. 35
Density, ? p. 35
Velocity, ?v p. 35
Momentum, ?v² p. 35
Mass Flow, ?v p. 36
Elemental analysis p. 36
The Four Possible Routes to MFM p. 37
Options for Measurement p. 40
Possible Device Combinations p. 41
Techniques depending on homogenisation p. 41
Techniques not dependent on homogenisation p. 44
Techniques depending on flow separation p. 44
Key Multiphase Flow Metering Techniques p. 47
Density Measurement p. 47
Weighing of pipe p. 47
The vibrating tube densitometer p. 50
Acoustic attenuation p. 52
Impedance p. 54
Single-beam gamma densitometer p. 61
Broad-beam gamma densitometer p. 66
Multi-beam gamma densitometer p. 71
Gamma-ray scattering p. 76
Neutron absorption p. 79
Neutron scattering p. 83
Microwave attenuation p. 88
Internal (GRAB) sampling p. 92
Isokinetic sampling p. 94
Infrared p. 97
Tomography p. 99
Velocity Measurement p. 107
Turbine flow meters p. 107
Vortex shedding meter p. 112
Acoustic velocity (pulse and return) p. 115
Acoustic cross-correlation p. 117
Electromagnetic flow meter p. 119